Partitioning Lake Okeechobee Scenario. DRAFT (9/11/98)

Description of Simulation

An initial investigation of the effect of partitioning Lake Okeechobee (LOK or lake) into two compartments (split-lake concept) was completed using the 2050 Base Run as a reference. Various system responses simulated with the split-lake concept were compared with the 2050 Base simulation. Performance measure graphics presented for this scenario do not make comparisons with any Restudy alternatives.

Assumptions

Background information regarding the nature of the simulation of the split-lake concept is listed below.

- The simulations essentially reflect modeling the Corps' Restudy 2050 Base Run with Lake Okeechobee divided into two compartments (littoral on the west and reservoir on the east) separated by an interior levee. This levee is assumed to be impervious and runs along the 2-foot contour line of the lake bathymetry. It joins the north and southeastern portions of the lake exterior levee (Hoover Dike) as shown in Figure 1. The littoral and reservoir compartments occupy 60% and 40%, respectively, of the total Lake Okeechobee surface area.

- A single line regulation schedule is adopted for the littoral compartment. If stage in the littoral compartment goes above the lower limit of Zone D in the proposed WSE operational schedule (Figure 2), then excess water, i.e. the amount beyond what is required from this compartment to meet downstream needs, is routed south to WCA-3A via STA3&4, again, subject to conveyance limitations. A 4,000 cfs capacity pump is used to lift water from the littoral to the reservoir compartment if the regulatory discharge south is not sufficient to bring water levels in the littoral compartment below the regulation schedule.

- No flood control (regulatory) release rule is implemented for the reservoir compartment. Its primary function is to meet downstream (environmental, agricultural and Lower East Coast water supply) needs subject to conveyance limitations when the stage in the littoral compartment is below regulation schedule. A dead storage concept is applied to the reservoir compartment: if the stage within this compartment goes below 2 ft NGVD, downstream needs, if any, will now be met from the littoral compartment subject to conveyance limitations.

- Supply-side management (SSM) can be optionally implemented for the littoral compartment during times when it is used to meet downstream needs after the reservoir compartment can no longer provide water to meet these needs due to extremely low storage: stages below 2 ft NGVD. (Note: Dead storage can be defined to correspond to zero storage in future split-lake scenarios.)

Significant Findings:

- Results from two model runs (**s**plit-**l**ake with **n**o **s**upply-**s**ide **m**anagement or **SLNSSM** and **s**plit-**l**ake **w**ith **s**upply-**s**ide **m**anagement or **SLWSSM**) are presented next. A standard set of performance measure graphics were generated to evaluate the performance of the two split-lake scenarios relative to the 20**50 B**ase **R**un or **50BSR**. A limited assessment of the feasibility of the split-lake concept can be summarized as follows.

- Significant reductions in the percentage demands-not-met on an annual average basis occurred in the EAA (50BSR:24, SLNSSM:1, SLWSSM:6) and other Lake Okeechobee Service Areas (50BSR:25, SLNSSM:7, SLWSSM:11). The simulation without SSM indicated that conveyance limitations alone contributes to demands-not-met (Figure 3).

- The stages in the reservoir range from less than 2 ft NGVD in 1977, 1978, 1981-82, and 1989-91 to more than 25 ft NGVD over a year starting in 1970 and towards the end of 1995. The carryover storage from the peak event in 1970 lasted over five years as shown in Figure 4.

- The stages in the littoral zone, in general, were much more favorable relative to the 2050 Base Run. Figure 5 shows the number of undesirable LOK stage events reduced from a total of 12 in 50BSR to 5 in either split-lake scenarios. Figure 6 shows that the percent of time LOK stages exceeded 15.0 ft NGVD decreased from 25 to 16; and the number of times the littoral zone was flooded over 182 consecutive days decrease from 8 to 1. In addition, the time series of water levels crossed through the desired spring recession window approximately ten more years (over 31 years of simulation) for either split-lake scenario over the 2050 Base Run, as depicted in Figure 7.

- Minimum stages in the littoral compartment during the simulation period for the SLNSSM scenario is about 7 ft NGVD in 1981-1982 and 1990, and about 8 ft NGVD for the SLWSSM scenario (Figure 4) which are both lower than the 50BSR case. On the other hand, the duration of time by which stages in the littoral compartment was below 10 ft - 12 ft was significantly reduced in both scenario runs. Thus, the long-term range and timing of stages in the littoral zone markedly improved due to the split-lake concept. Also, supply-side management policy for the littoral compartment minimizes the number of occurrences of excessively low stage events.

- Short-term dryouts, on the other hand, are less frequent (and thus, less desirable) in the split-lake runs compared to the 2050 Base Run, as shown in Figure 8. A more intelligent operation of the littoral compartment should be proposed to circumvent this drawback.

- The cumulative storage over the 31 years of simulation for either scenario runs was about 2 million acre-feet greater than the total cumulative storage for 2050 Base Run.

- Flood control discharges from the littoral compartment to the Caloosahatchee and St. Lucie estuaries were eliminated while the discharges south to the Water Conservation Areas more than doubled (Figure 9). This increase was primarily due to the difference in the regulation schedules used in the 2050 Base Run (RUN25 schedule) and the split-lake scenario runs (WSE schedule). The WSE schedule commences flood control releases south at levels (range:13.50-15.50 ft NGVD) lower than the RUN25 schedule (range:15.65-16.75 ft NGVD).

- A positive consequence of the increased lake discharges to the south was some improvement in NSM hydroperiod matching for the Water Conservation Areas (WCAs) (Figure 10) and Everglades National Park (ENP) (Figure 11) as a whole, and most of the individual WCAs.

- There was a significant decrease in the number of ssm- and dry_season- triggered public water supply cutback months for all LEC Service Areas. Locally-triggered cutbacks for all three runs are practically the same (Figure 12).

- The average annual LOK water supply deliveries to LEC Service Areas 1 and 2 for the three runs are very similar. The same type of surface water delivery to Service Area 3 decreased (Figure 13). This was probably due to increased LOK releases to the Everglades which resulted into: 1) greater storage in WCA3B and ENP; 2) more seepage across the protective levees into LECSA3, thus, effectively recharging the underlying aquifer in the service area; and 3) reduction of water required from the regional system (LOK and WCAs) to maintain LECSA3 canals which, in turn, provide groundwater recharge to the same aquifer (Figure 14).
- In the Caloosahatchee estuary, a significant reduction in the number of high flow violations were due to the elimination of LOK regulatory releases in the split-lake scenario runs. Low-flow violations did not significantly change from 50BSR to either SLWSSM or SLNSSM (Figure 15).

- The same reductions in the number of high-flow violations were obtained for St. Lucie estuary (Figure 16). The number of low-flow violations (number of months average flow <350 cfs) increased from the 2050 Base Run to the split-lake scenario runs. In all three runs, St. Lucie (C44) basin runoff are assumed to naturally flow to the west (of S-308), instead of to the east (of S-80) into the estuary when stages in the lake (or reservoir for the split-lake scenario) are less than 14.5 ft NGVD. Most of the increased violations in the number of low-flow violations probably occurred during the 1970s when the water levels in the reservoir compartment were consistently below 14.5 ft NGVD. This drawback can be offset by imposing an explicit minimum estuarine flow requirement which can be met by C-44 basin runoff, if so desired. Note that no minimum estuarine flow requirement is imposed in the 2050 Base Run.

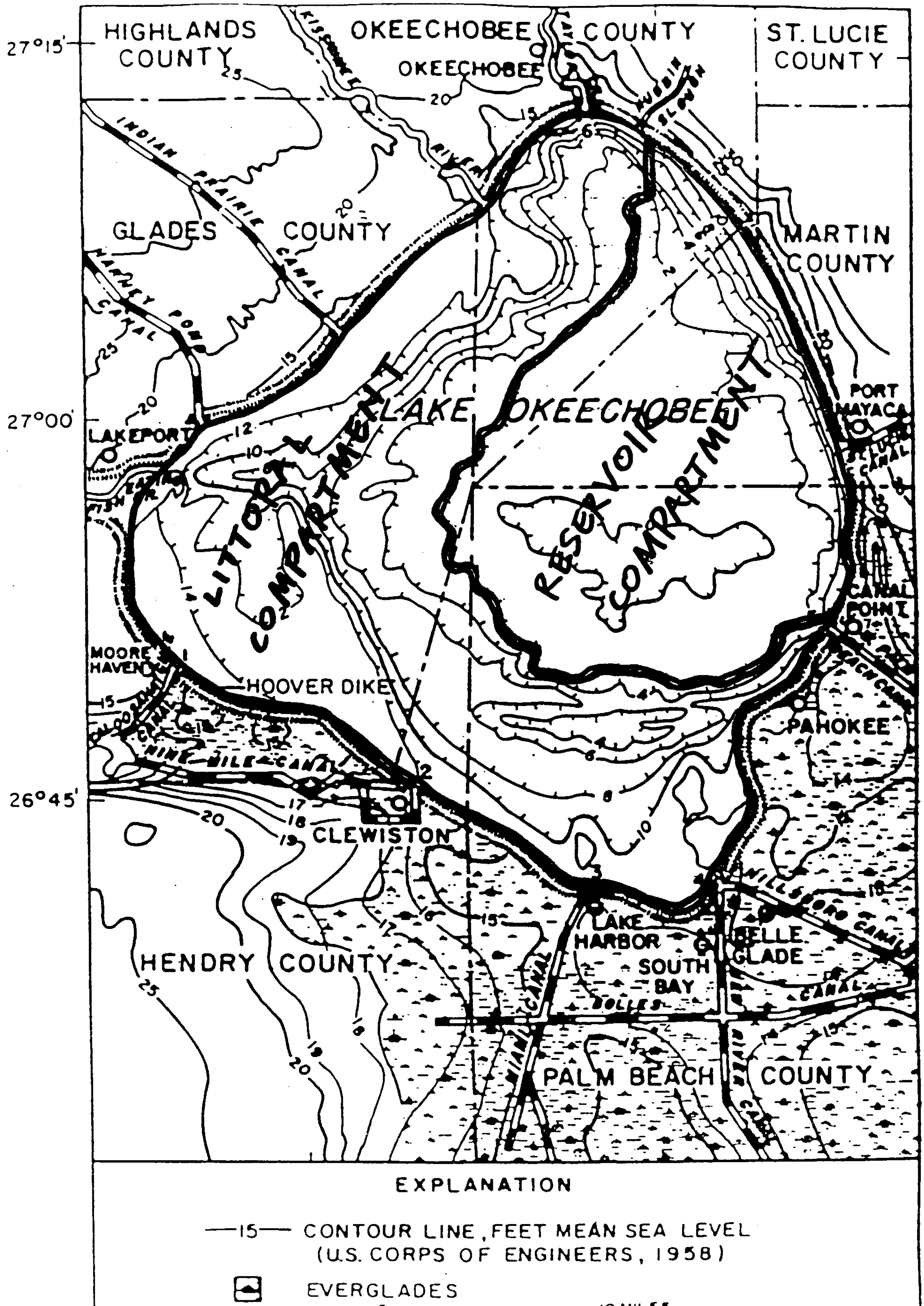
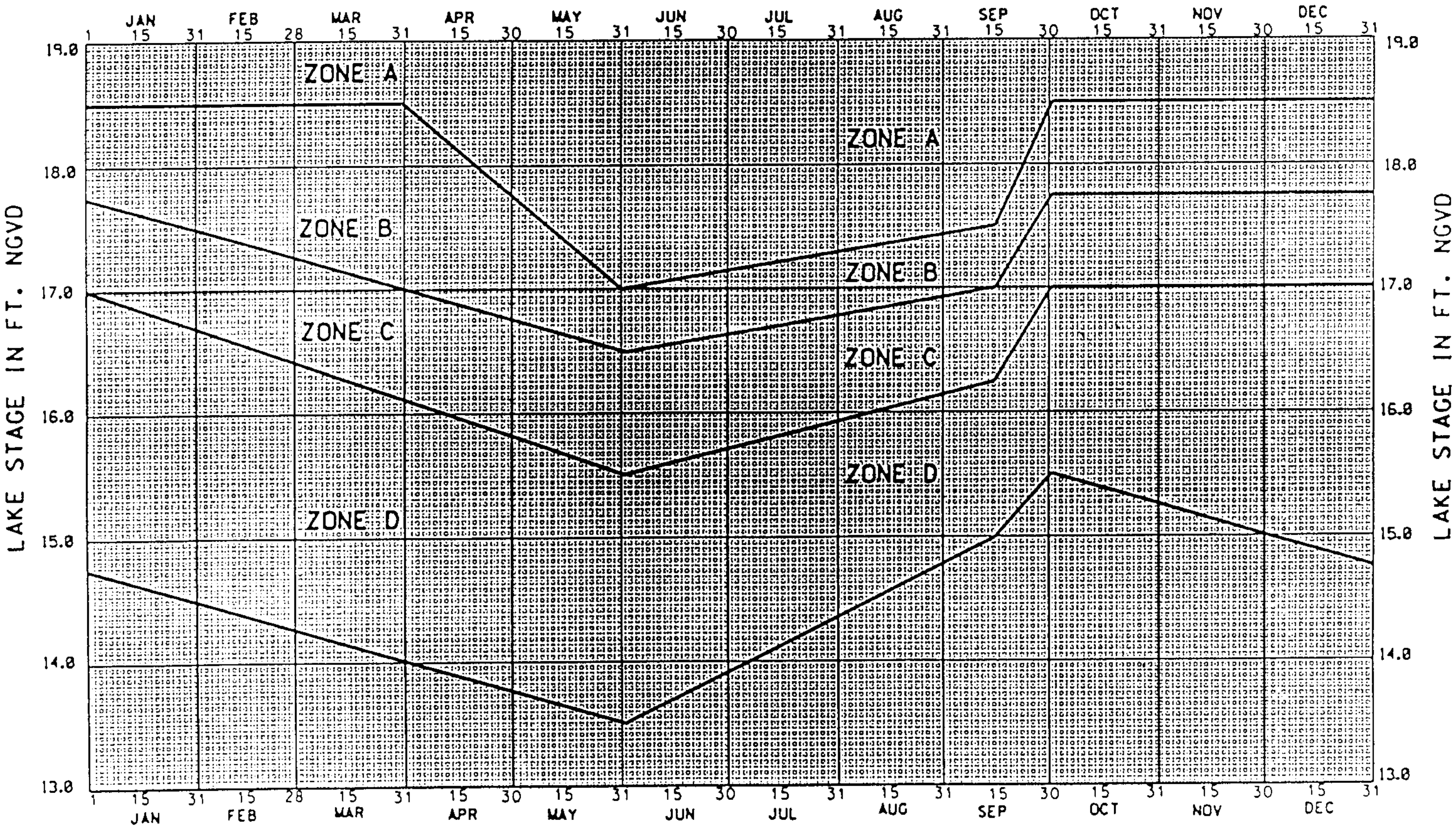


FIGURE 1 Map of Lake Okeechobee area showing topography and principal drainage.

FIGURE 2. Alternative Operational Schedule (WSE)



RELEASE THROUGH OUTLETS AS INDICATED

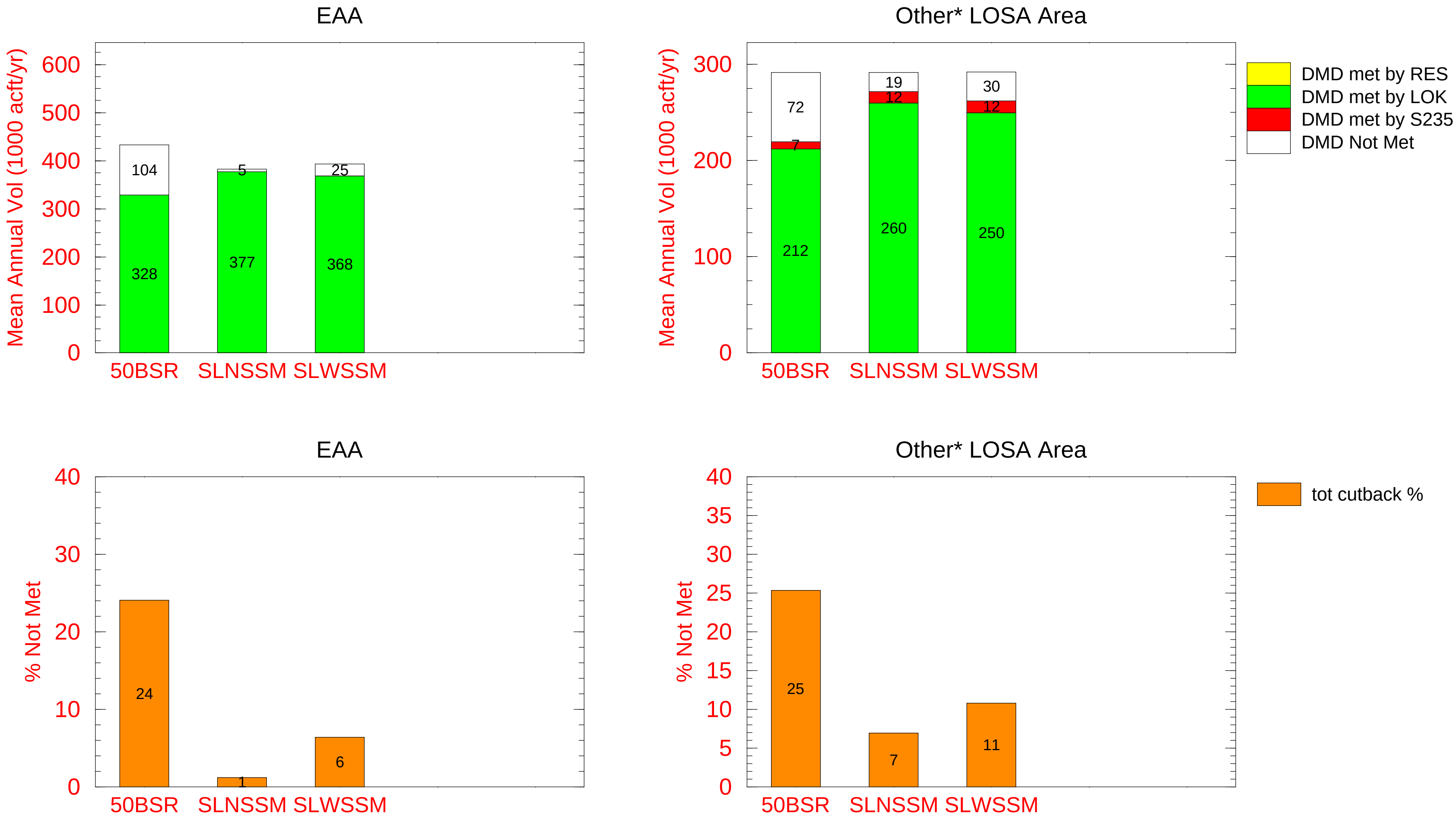
ZONE	AGRICULTURAL CANALS To WCAs (1)	CALOOSAHATCHEE RIVER AT S-77 (1,2,4)	ST. LUCIE CANAL AT S-80 (1,2,4)
A	PUMP MAXIMUM PRACTICABLE	UP TO MAXIMUM CAPACITY	UP TO MAXIMUM CAPACITY
B (3)	MAXIMUM PRACTICABLE RELEASES	NORMAL TO WET: UP TO 6500 CFS DRY: UP TO MAXIMUM PULSE RELEASE	NORMAL TO WET: UP TO 3500 CFS DRY: UP TO MAXIMUM PULSE RELEASE
C (3)	MAXIMUM PRACTICABLE RELEASES	WET: UP TO 4500 CFS NORMAL: UP TO MAXIMUM PULSE RELEASE DRY: NONE	WET: UP TO 2500 CFS NORMAL: UP TO MAXIMUM PULSE RELEASE DRY: NONE
D (3)	AS NEEDED TO ENHANCE NATURAL HYDROPERIODS IN THE EVERGLADES	VERY WET: PULSE RELEASE OTHERWISE: NONE	VERY WET: PULSE RELEASE OTHERWISE: NONE

NOTES:
(1) SUBJECT TO FIRST REMOVAL OF RUNOFF FROM DOWNSTREAM BASINS
(2) GUIDELINES FOR WET, DRY AND NORMAL CONDITIONS ARE BASED ON: 1) SELECTED CLIMATIC INDICES AND TROPICAL FORECASTS AND 2) PROJECTED INFLOW CONDITIONS
(3) RELEASES THROUGH VARIOUS OUTLETS MAY BE MODIFIED TO MINIMIZE DAMAGES OR OBTAIN ADDITIONAL BENEFITS. CONSULTATION WITH EVERGLADES AND ESTUARINE BIOLOGISTS IS ENCOURAGED TO MINIMIZE ADVERSE EFFECTS TO DOWNSTREAM ECOSYSTEMS. RELEASES SHOULD BE PUMPED WHEN NECESSARY FOR THE ENHANCEMENT OF THE EVERGLADES NATURAL HYDROPERIOD
(4) PULSE RELEASES ARE MADE TO MINIMZE ADVERSE IMPACTS TO THE ESTUARIES

DRAFT PROPOSED REGULATION SCHEDULE
LAKE OKEECHOBEE
SOUTH FLORIDA WATER MANAGEMENT DISTRICT
WEST PALM BEACH, FLORIDA
DATED: 15 APRIL 1998
WSE

Fig. 3 Mean Annual EAA/LOSA Supplemental Irrigation: Demands and Demands Not Met

for the 1965 − 1995 Simulation Period



*Other Lake Service SubAreas (S236, S4, L8, C43, C44, and Seminole Indians (Brighton & Big Cypress)).

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Fig. 4 Daily Stage Hydrographs for Lake Okeechobee

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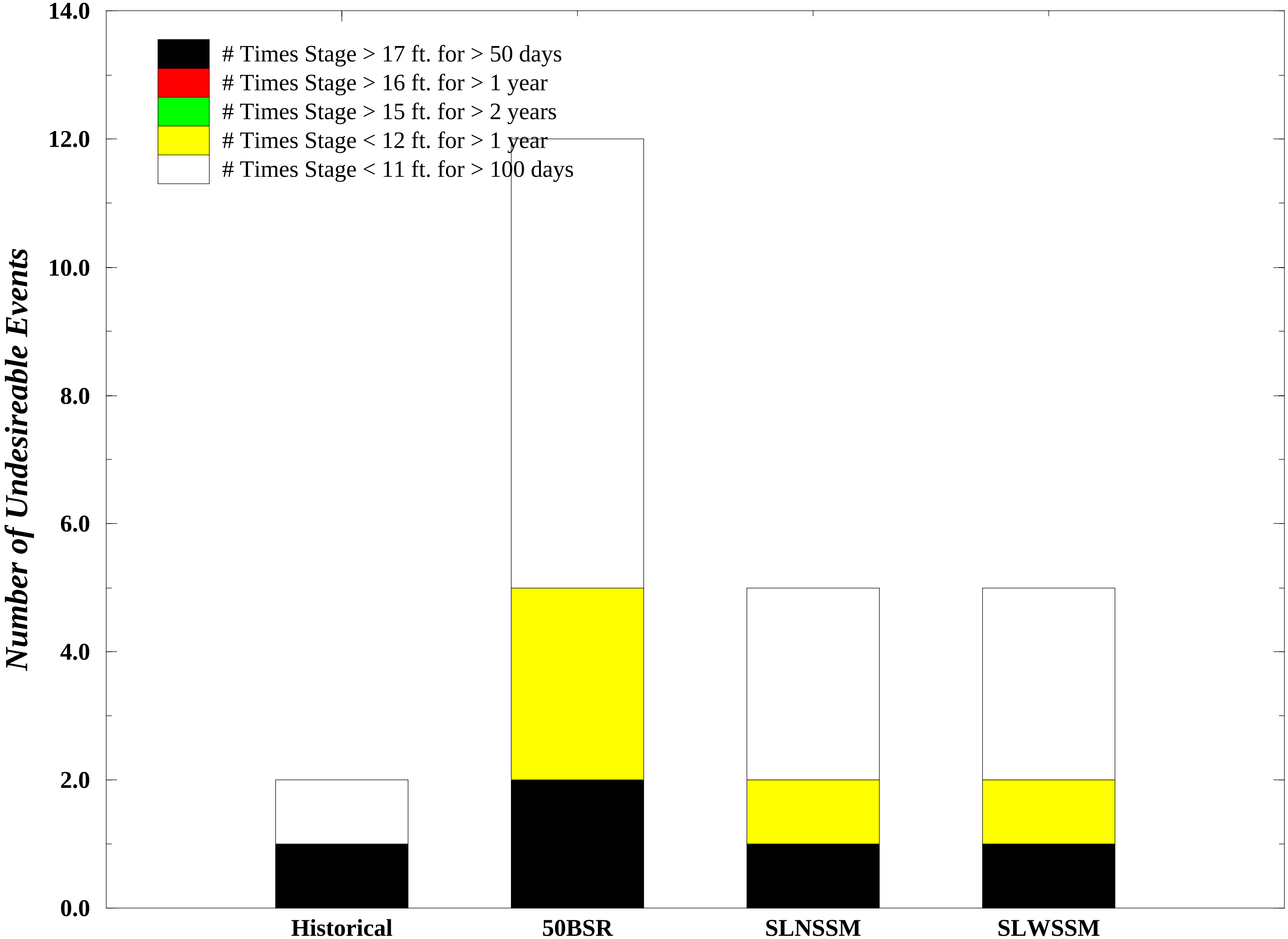
Fig. 5 Number of Undesireable Lake Okeechobee Stage Events



Simulated Alternatives (1965−1995) Compared with Historical Stages (1953−1972)

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Fig. 6 Percent of Time Lake Stages Equaled or Exceeded 15ft NGVD AND Number of Times Littoral Zone Flooded > 365/182 Consecutive Days

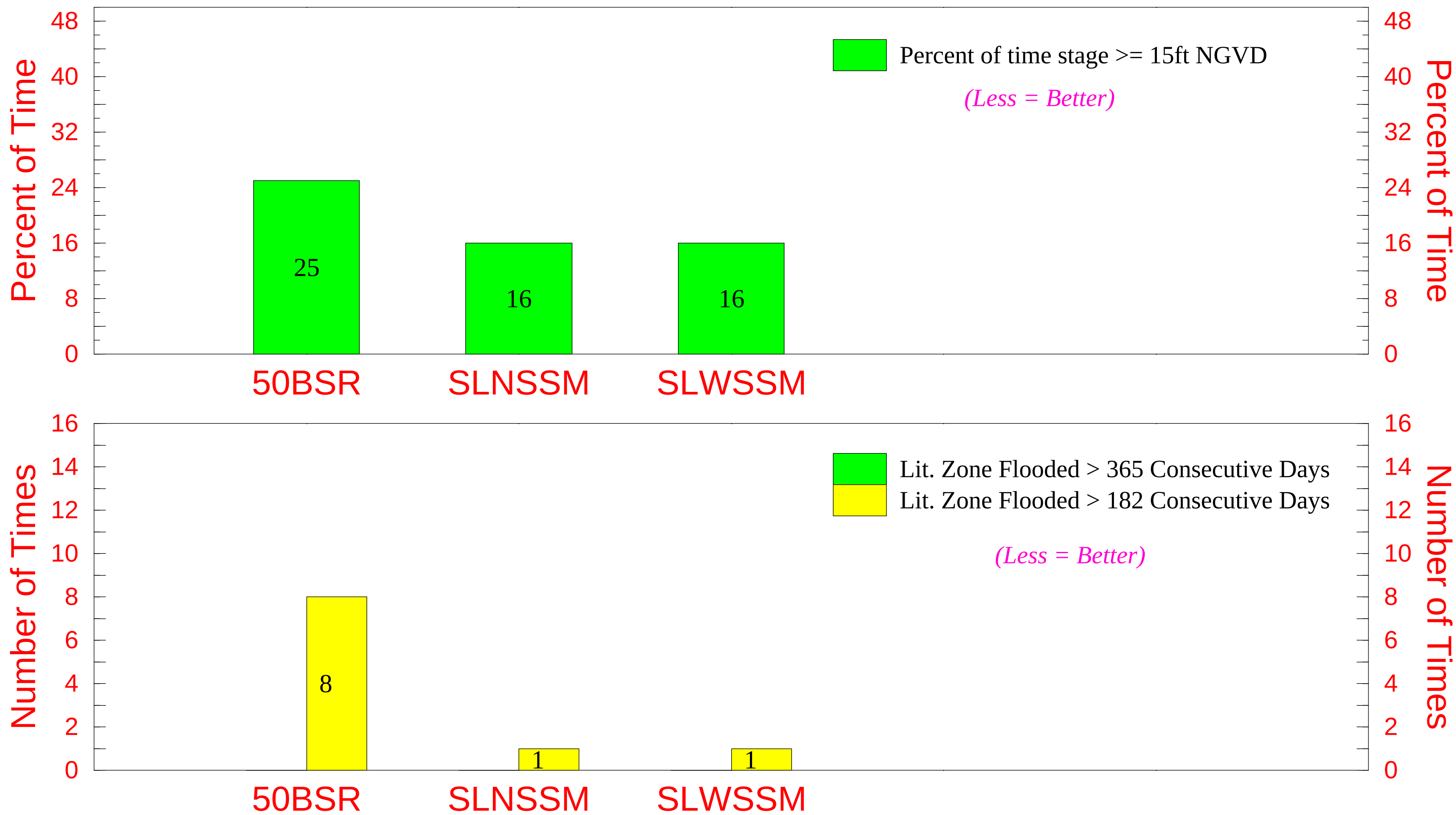

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Fig. 7 Daily Stage Hydrographs for Lake Okeechobee
Spring Water Level Recession Windows

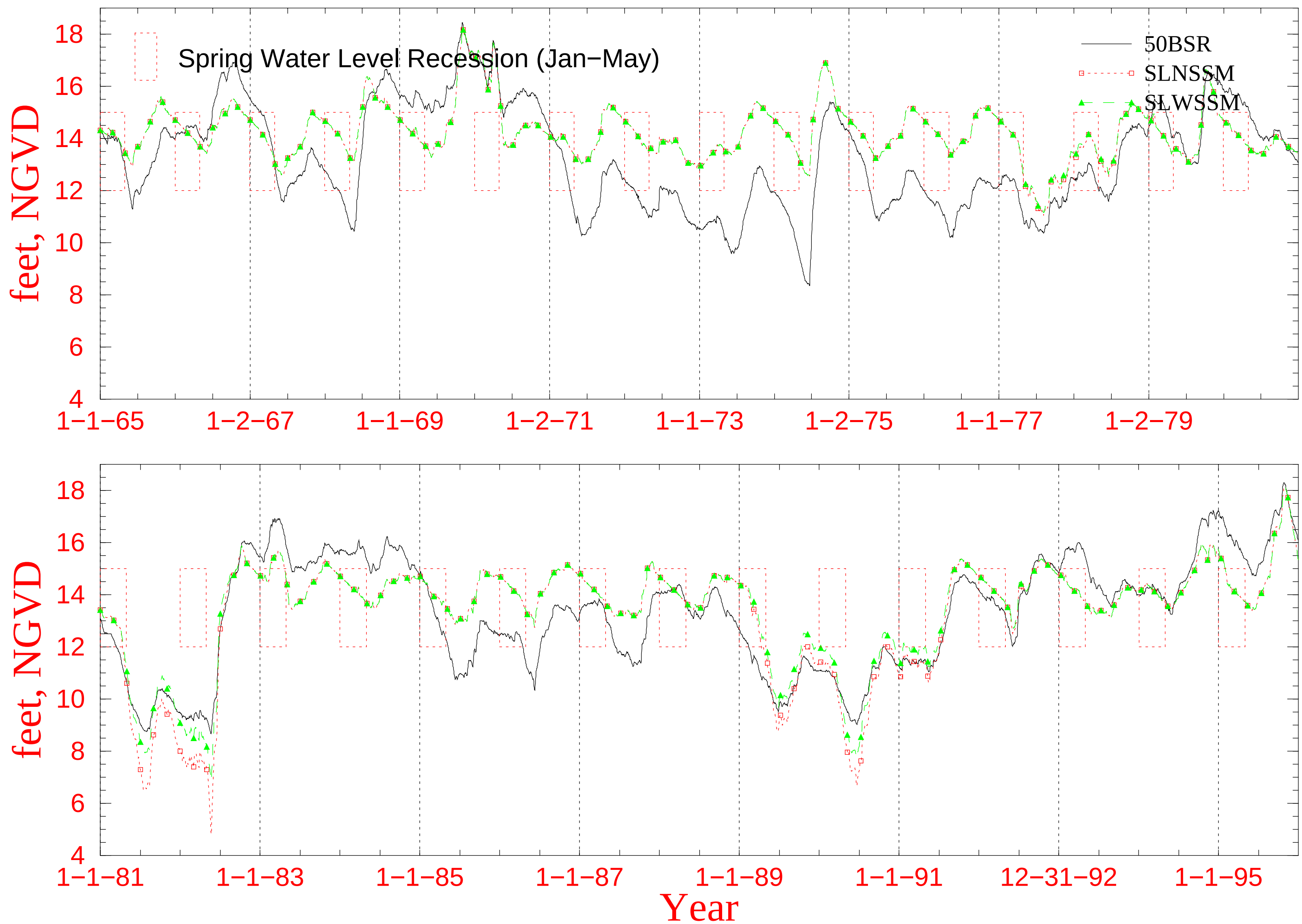

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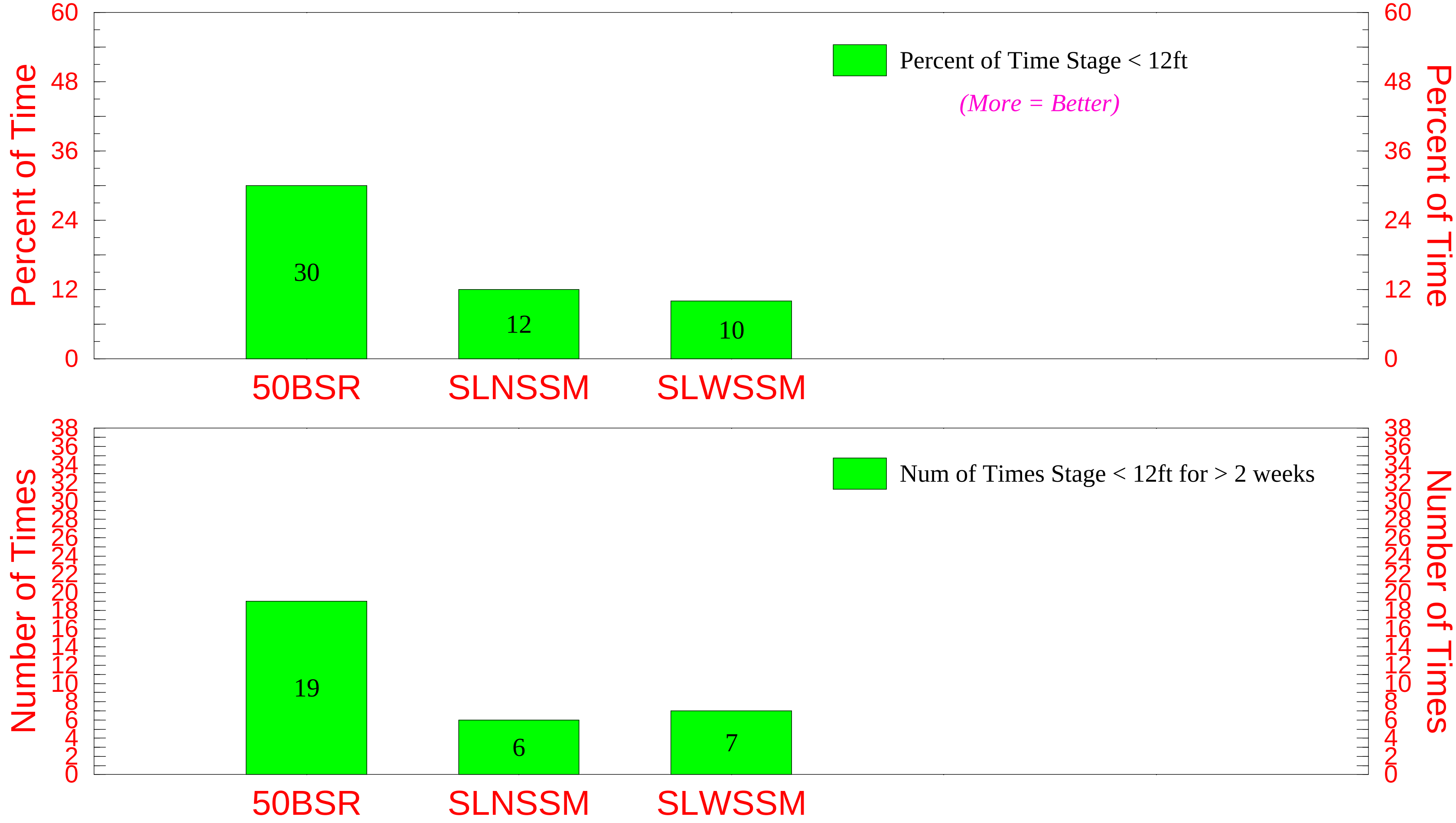
Fig. 8 Percent of Time Lake Stages Fell < 12ft NGVD AND Num of Times Lake < 12ft NGVD for > 2 weeks



* Short−term drying of the marsh allows for seed germination of beneficial plants, improves wading bird and snail kite habitat (eg. regrowth of willow) and helps to maintain the natural diversity and abundance of littoral zone biological communities.

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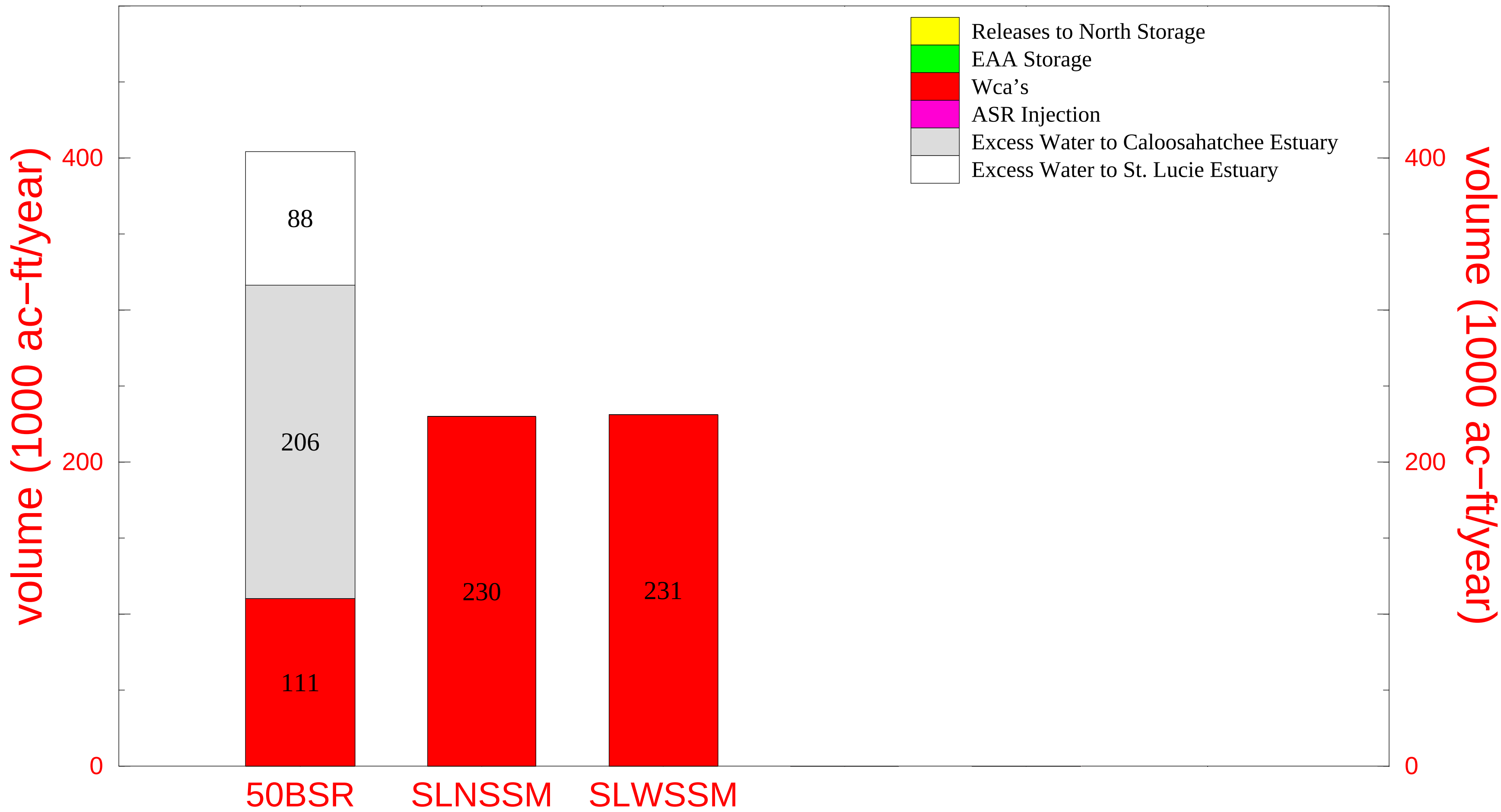
Fig. 9 Mean Annual Flood Control Releases from Lake Okeechobee for the 31−yr. (1965 − 1995) Simulation



Note: Although regulatory (flood control) discharges are summarized here in mean annual values, they do not occur every year. Typically they occur in 2−4 consecutive years and may not occur for up to 7 consecutive years.

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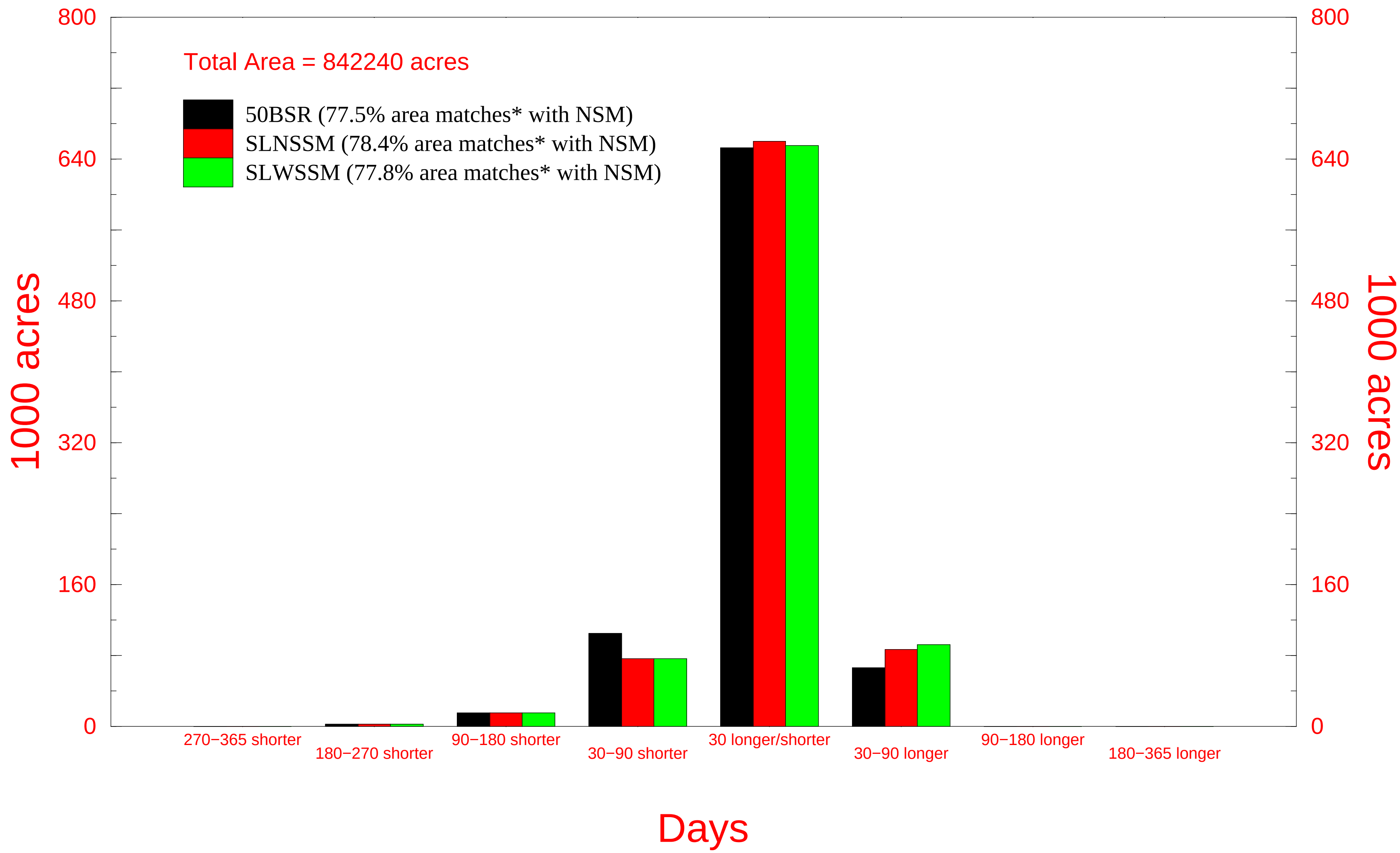
Fig. 10 Mean NSM Hydroperiod Matches for the WCA SYSTEM for the 31−yr. Simulation



Note: xaxis represents hydroperiod days shorter or longer as compared to NSM
*Match corresponds to 30 hydroperiod days shorter or longer than NSM.

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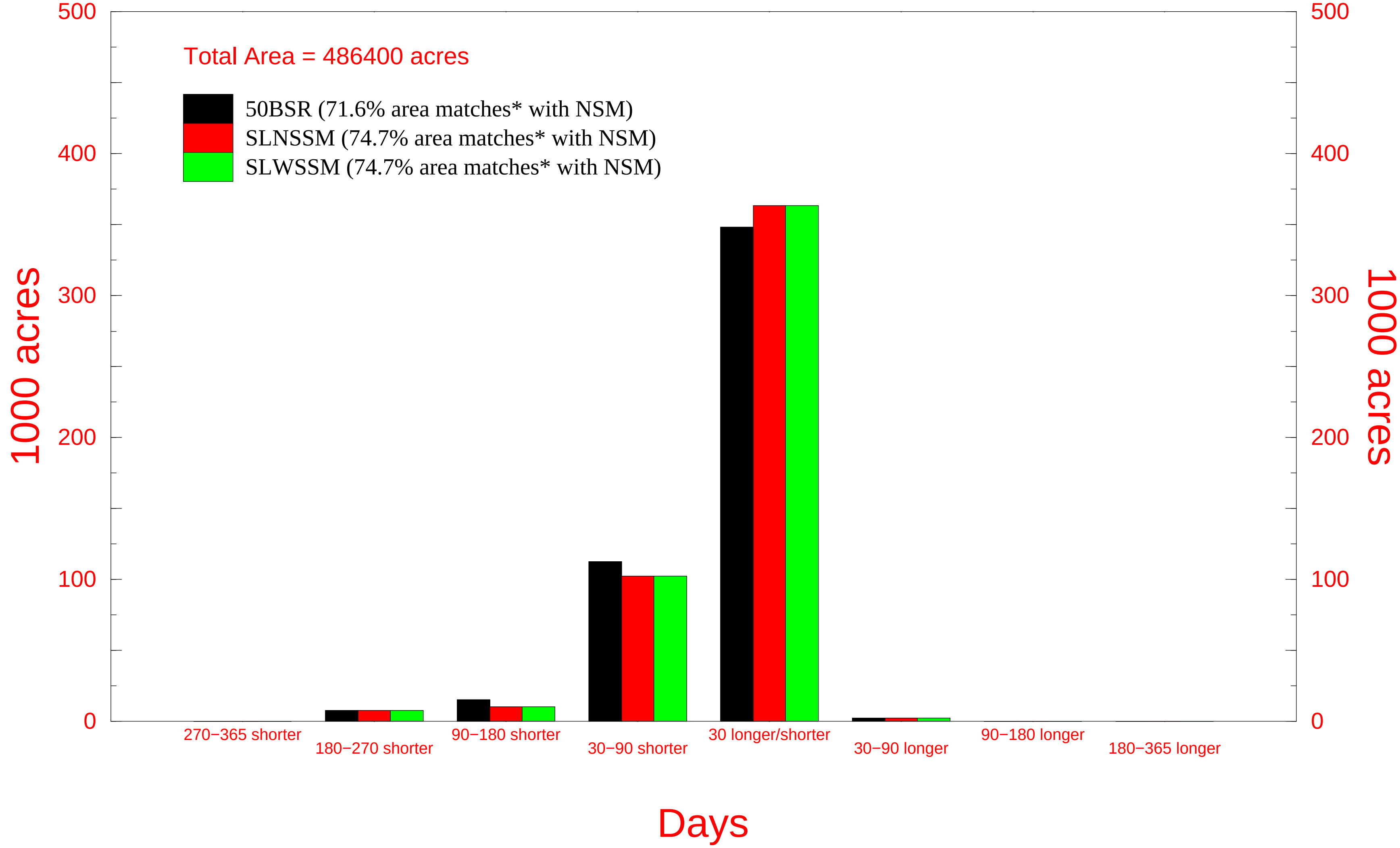
Fig. 11 Mean NSM Hydroperiod Matches for the Everglades National Park for the 31−yr. Simulation



Note: xaxis represents hydroperiod days shorter or longer as compared to NSM
*Match corresponds to 30 hydroperiod days shorter or longer than NSM.

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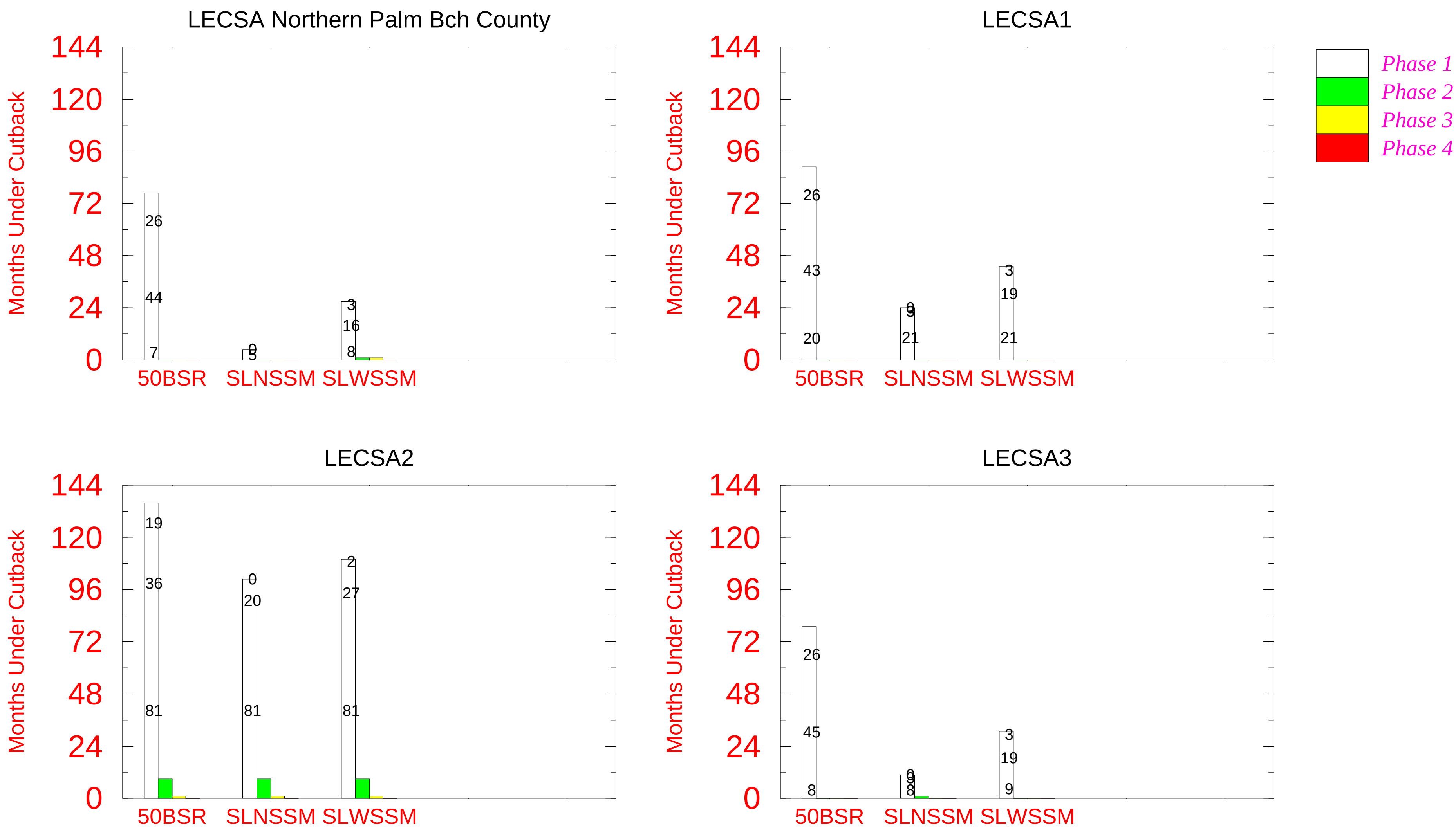
Fig. 12 Number of Months of Simulated Water Supply Cutbacks for the 1965 − 1995 Simulation Period



Note: Phase 1 water restrictions could be induced by a) Lake stage in Supply Side Management Zone (indicated by upper data label), b) Local Trigger well stages (lower data label), and c) Dry season criteria (indicated by middle data label).

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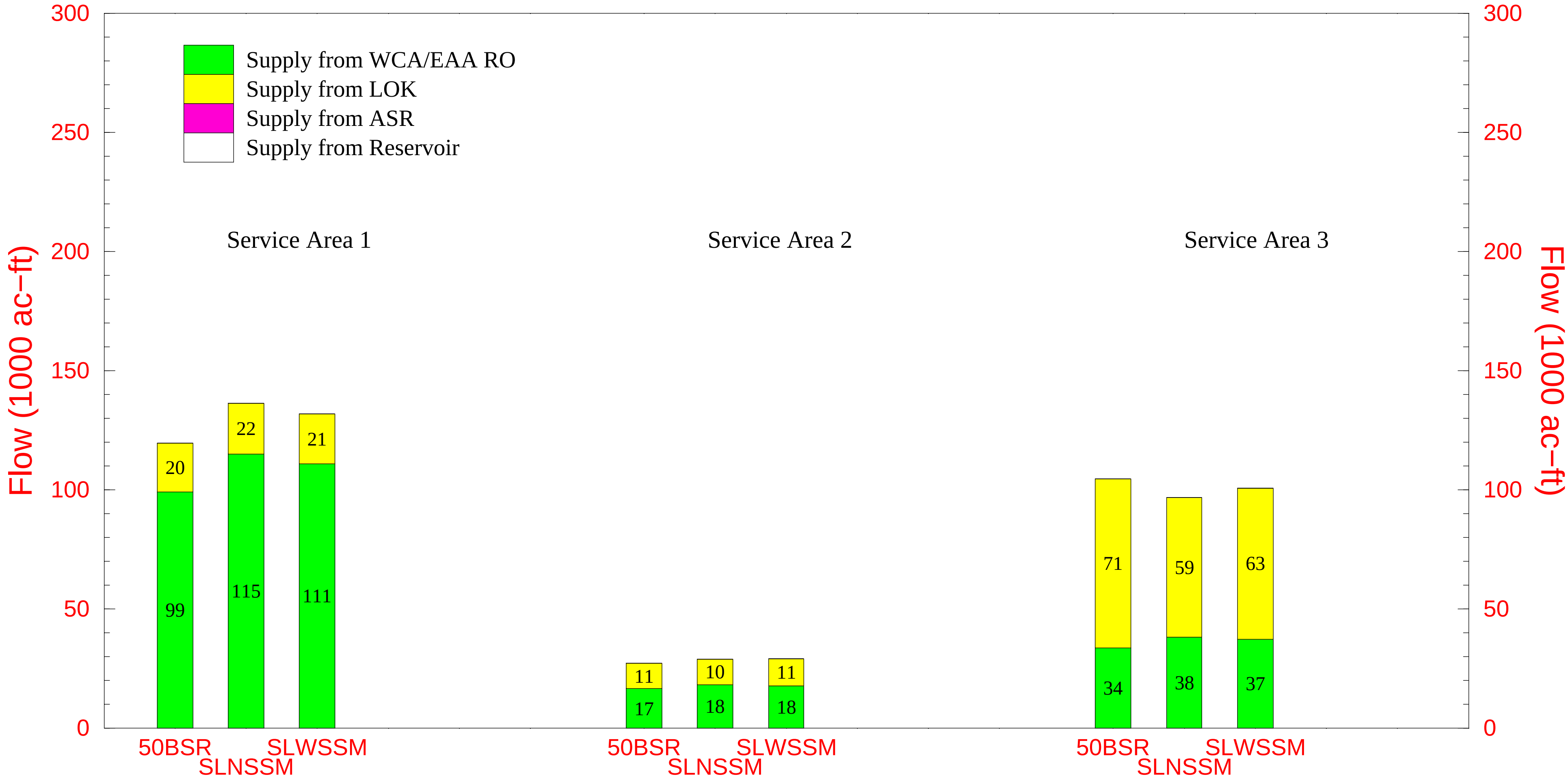
Fig. 13 Average Annual Regional System Water Supply Deliveries to LEC Service Areas for the 1965 − 1995 simulation



Note: Structure flows included: SA1=S39+LWDD+ADDSLW+ACMEWS+WSL8S+HLFASR+C51FAS+WSC1+S1ATHL+CPBRWS+BPRL8S
SA2=S38+S34+NNRFAS; SA3=S31+S334+S337+BRDRWS+LBTC6+LBTDBL+LBTL30+LBTSC+LBTC9+LBTC2+C9RWS
Supply RECEIVED from LOK may be less than what is DELIVERED at LOK due to conveyance constraints.
Regional System is comprised of LOK and WCAs.

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Fig. 14 Average Annual Ground Water & Levee Seepage Flows from WCA's & ENP to LEC for 1965 − 1995 Simulation Period

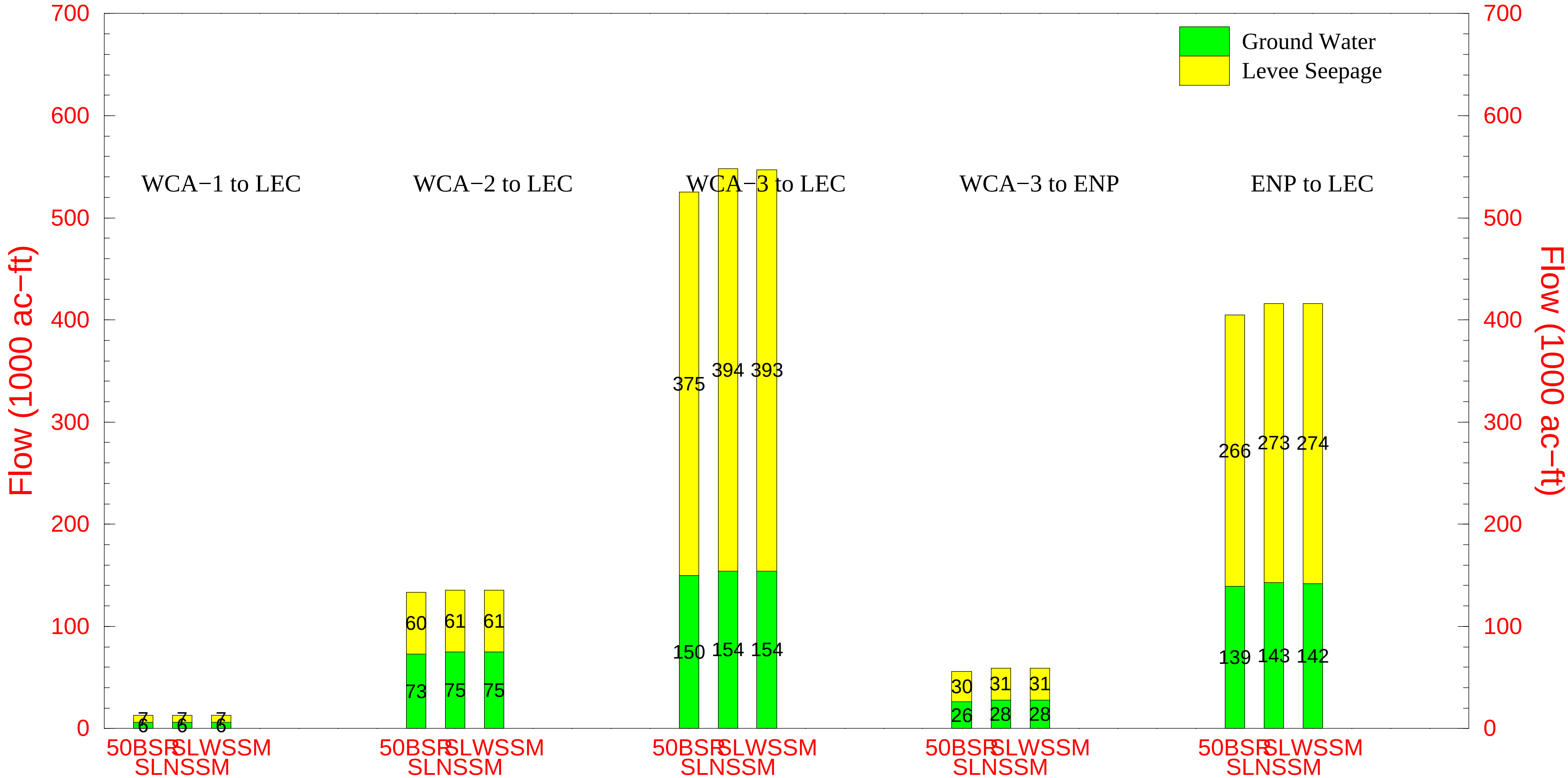

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Fig. 15 Number of Times Salinity Envelope Criteria were NOT met for the Caloosahatchee Estuary (mean monthly flows 1965 − 1995)

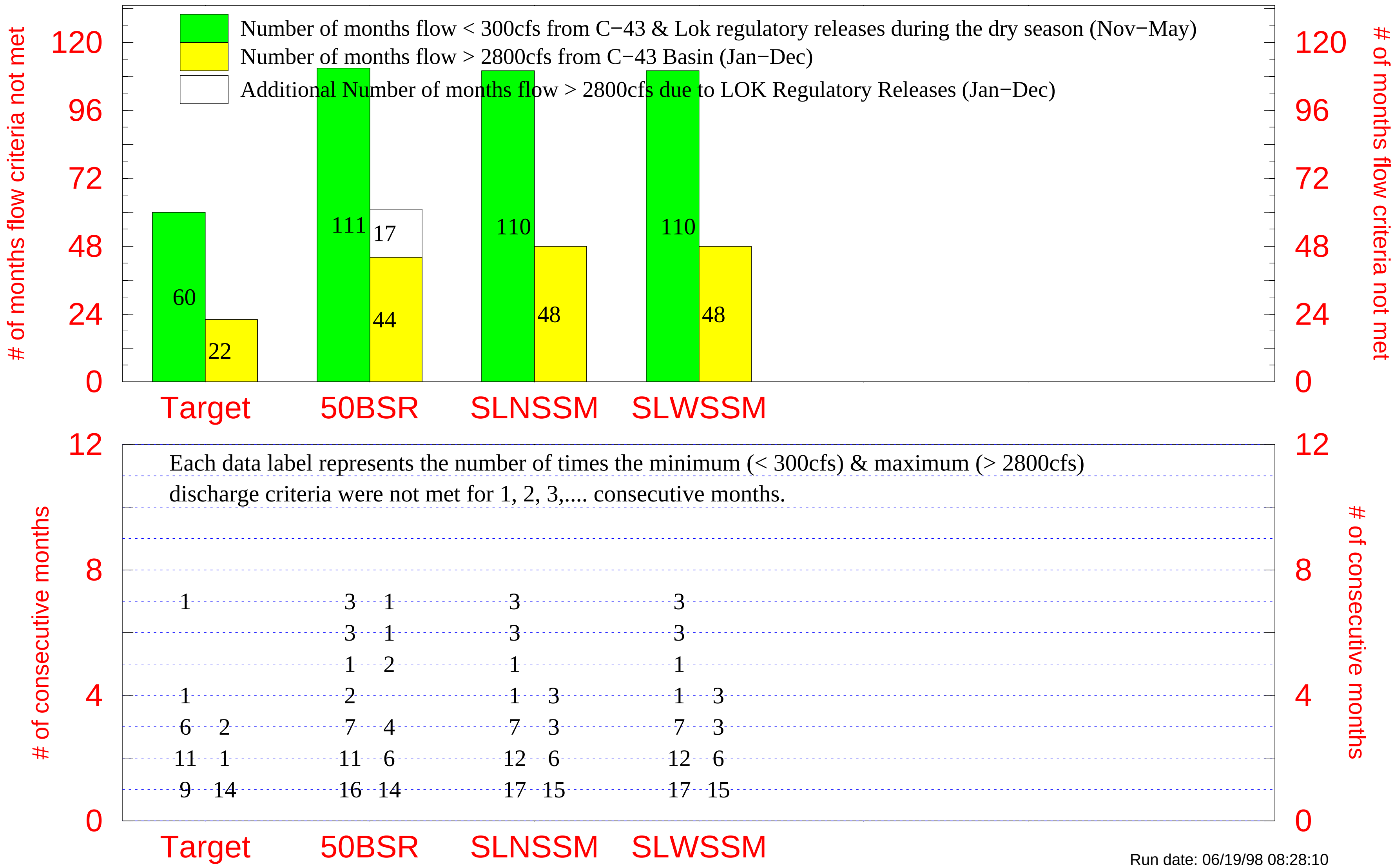

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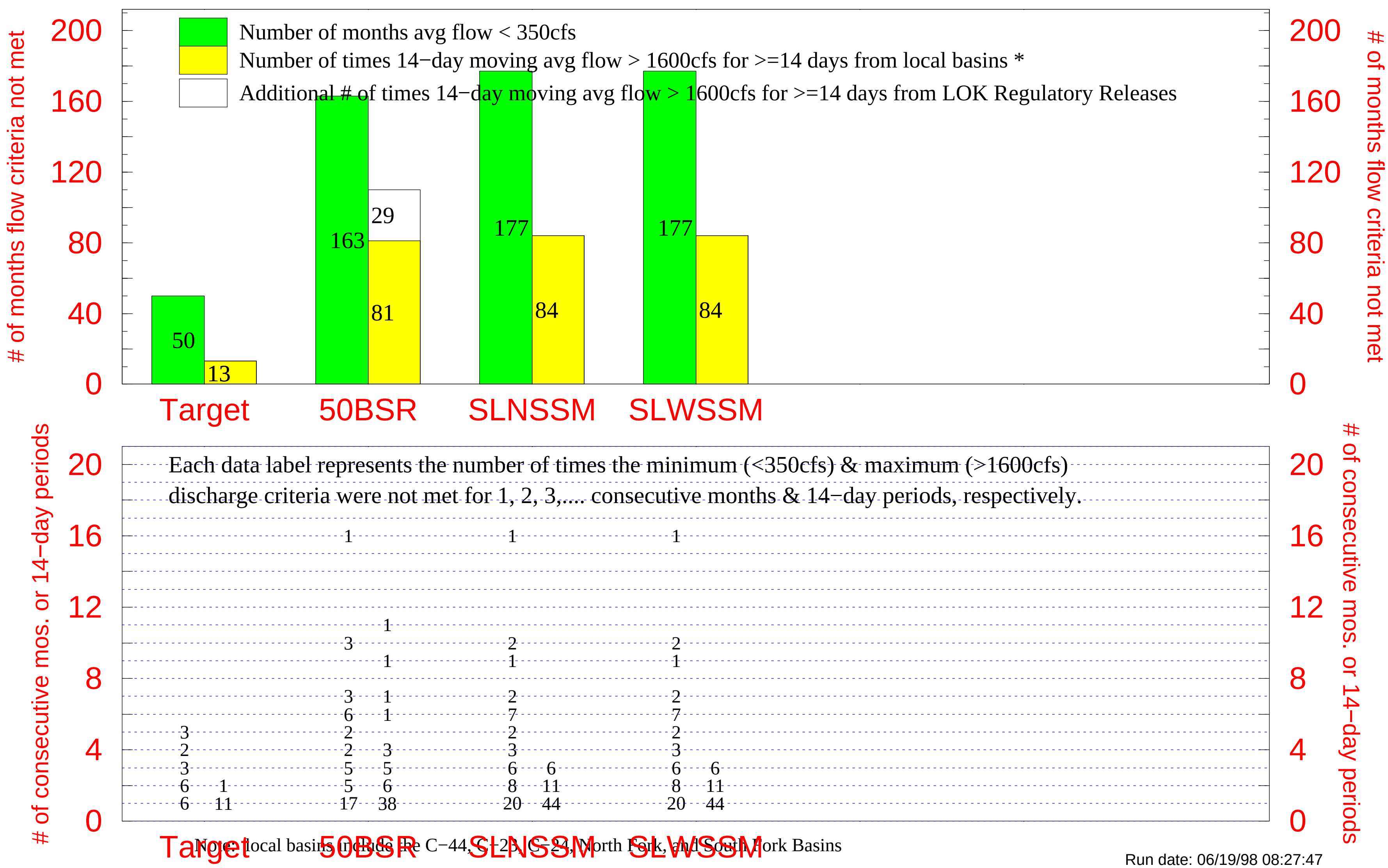
Fig. 16 Number of Times Salinity Envelope Criteria were NOT met for the St. Lucie Estuary



Note: local basins include the C−44, C−23, C−24, North Fork, and South Fork Basins

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